

Introduction

This report presents the major assumptions of the National Energy Modeling System (NEMS) used to generate the projections in the *Annual Energy Outlook 2003*¹ (AEO2003), including general features of the model structure, assumptions concerning energy markets, and the key input data and parameters that are most significant in formulating the model results. Detailed documentation of the modeling system is available in a series of documentation reports.² A synopsis of NEMS, the model components, and the interrelationships of the modules is presented in *The National Energy Modeling System: An Overview*.³

The National Energy Modeling System

The projections in the AEO2003 were produced with the National Energy Modeling System. NEMS is developed and maintained by the Office of Integrated Analysis and Forecasting of the Energy Information Administration (EIA) to provide projections of domestic energy-economy markets in the midterm time period and perform policy analyses requested by decisionmakers and analysts in the U.S. Congress, the Department of Energy's Office of Policy and International Affairs, other DOE offices, and other government agencies.

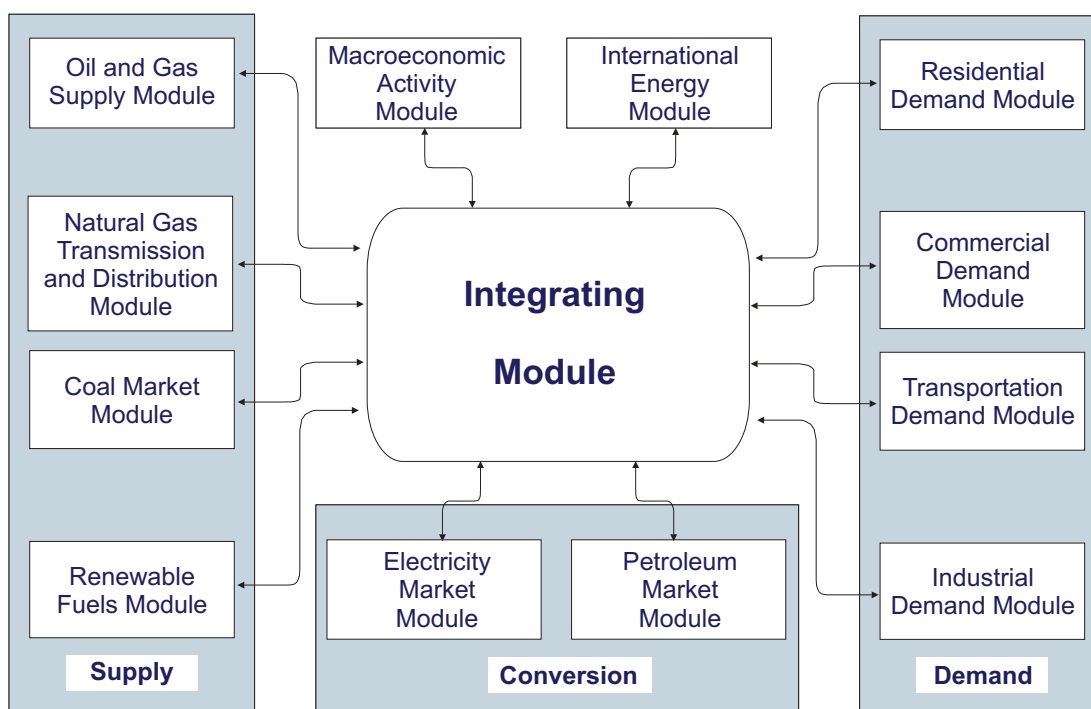
The time horizon of NEMS is approximately 20 years, the midterm period in which the structure of the economy and the nature of energy markets are sufficiently understood that it is possible to represent considerable structural and regional detail. Because of the diverse nature of energy supply, demand, and conversion in the United States, NEMS supports regional modeling and analysis in order to represent the regional differences in energy markets, to provide policy impacts at the regional level, and to portray transportation flows. The level of regional detail for the end-use demand modules is the nine Census divisions. Other regional structures include production and consumption regions specific to oil, gas, and coal supply and distribution, the North American Electric Reliability Council regions and subregions for electricity, and aggregations of the Petroleum Administration for Defense Districts (PADD) for refineries. Only national results are presented in the AEO2003, with the regional and other detailed results available on the EIA Home Page. (<http://www.eia.doe.gov/oiaf/aeo/index.html>)

For each fuel and consuming sector, NEMS balances the energy supply and demand, accounting for the economic competition between the various energy fuels and sources. NEMS is organized and implemented as a modular system (Figure 1). The modules represent each of the fuel supply markets, conversion sectors, and end-use consumption sectors of the energy system. NEMS also includes macroeconomic and international modules. The primary flows of information among each of these modules are the delivered prices of energy to the end user and the quantities consumed by product, region, and sector. The delivered prices of fuel encompass all the activities necessary to produce, import, and transport fuels to the end user. The information flows also include other data such as economic activity, domestic production activity, and international petroleum supply availability.

The integrating module of NEMS controls the execution of each of the component modules. To facilitate modularity, the components do not pass information to each other directly but communicate through a central data storage location. This modular design provides the capability to execute modules individually, thus allowing decentralized development of the system and independent analysis and testing of individual modules. This modularity allows use of the methodology and level of detail most appropriate for each energy sector. NEMS solves by calling each supply, conversion, and end-use demand module in sequence until the delivered prices of energy and the quantities demanded have converged within tolerance, thus achieving an economic equilibrium of supply and demand in the consuming sectors. Solution is reached annually through the midterm horizon. Other variables are also evaluated for convergence such as petroleum product imports, crude oil imports, and several macroeconomic indicators.

Each NEMS component also represents the impact and cost of legislation and environmental regulations that affect that sector. NEMS reflects all current legislation and environmental regulations, such as the Clean Air Act Amendments of 1990 (CAAA90), and the costs of compliance with other regulations. NEMS also includes an analysis of the impacts of voluntary programs to reduce energy demand and carbon dioxide emissions, which are separately described under each module.

Figure 1. National Energy Modeling System



Component Modules

The component modules of NEMS represent the individual supply, demand, and conversion sectors of domestic energy markets and also include international and macroeconomic modules. In general, the modules interact through values representing the prices of energy delivered to the consuming sectors and the quantities of end-use energy consumption. This section provides brief summaries of each of the modules.

Macroeconomic Activity Module

The Macroeconomic Activity Module provides a set of essential macroeconomic drivers to the energy modules and a macroeconomic feedback mechanism within NEMS. Key macroeconomic variables include gross domestic product (GDP), interest rates, disposable income, and employment. Industrial drivers are calculated for 35 industrial sectors. This module uses the following Global Insight (formerly DRI-WEFA) models: Macroeconomic Model of the U.S. Economy, National Industrial Shipments Model, National Employment Model, and Regional Model. In addition, EIA has constructed a Commercial Floorspace Model to forecast 13 floorspace types in 9 Census Divisions.

International Energy Module

The International Module represents the world oil markets, calculating the average world oil price and computing supply curves for five categories of imported crude oil for the Petroleum Market Module (PMM) of NEMS, in response to changes in U.S. import requirements. International petroleum product supply curves, including curves for oxygenates, are also calculated and provided to the PMM.

Household Expenditures Module

The Household Expenditures Module provides estimates of average household direct expenditures for energy used in the home and in private motor vehicle transportation. The forecasts of expenditures reflect the projections from NEMS for the residential and transportation sectors. The projected household energy

expenditures incorporate the changes in residential energy prices and motor gasoline price determined in NEMS, as well as changes in the efficiency of energy use for residential end uses and in light-duty vehicle fuel efficiency. Estimates of average expenditures for households are provided by income group and Census division.

Residential and Commercial Demand Modules

The Residential Demand Module forecasts consumption of residential sector energy by housing type and end use, subject to delivered energy prices, availability of renewable sources of energy, and housing starts. The Commercial Demand Module forecasts consumption of commercial sector energy by building types and nonbuilding uses of energy and by category of end use, subject to delivered prices of energy, availability of renewable sources of energy, and macroeconomic variables representing interest rates and floorspace construction. Both modules estimate the equipment stock for the major end-use services, incorporating assessments of advanced technologies, including representations of renewable energy technologies and effects of both building shell and appliance standards. Both modules include a representation of distributed generation.

Industrial Demand Module

The Industrial Demand Module forecasts the consumption of energy for heat and power and for feedstocks and raw materials in each of 16 industry groups, subject to the delivered prices of energy and macroeconomic variables representing employment and the value of shipments for each industry. The industries are classified into three groups—energy-intensive, non-energy-intensive, and nonmanufacturing. Of the eight energy-intensive industries, seven are modeled in the Industrial Demand Module with components for boiler/steam/cogeneration, buildings, and process/assembly use of energy. A representation of cogeneration and a recycling component are also included. The use of energy for petroleum refining is modeled in the Petroleum Market Module, and the projected consumption is included in the industrial totals.

Transportation Demand Module

The Transportation Demand Module forecasts consumption of transportation sector fuels, including petroleum products, electricity, methanol, ethanol, compressed natural gas, and hydrogen by transportation mode, vehicle vintage, and size class, subject to delivered prices of energy fuels and macroeconomic variables representing disposable personal income, GDP, population, interest rates, and the value of output for industries in the freight sector. Fleet vehicles are represented separately to allow analysis of CAAA90 and other legislative proposals, and the module includes a component to explicitly assess the penetration of alternative-fuel vehicles.

Electricity Market Module

The Electricity Market Module represents generation, transmission, and pricing of electricity, subject to delivered prices for coal, petroleum products, and natural gas; costs of generation by centralized renewables; macroeconomic variables for costs of capital and domestic investment; and electricity load shapes and demand. There are three primary submodules—capacity planning, fuel dispatching, and finance and pricing. Nonutility generation, distributed generation, and transmission and trade are represented in the planning and dispatching submodules. The levelized fuel cost of uranium fuel for nuclear generation is directly incorporated into the Electricity Market Module. All CAAA90 compliance options are explicitly represented in the capacity expansion and dispatch decisions. New generating technologies for fossil fuels, nuclear, and renewables compete directly in the decisions.

Renewable Fuels Module

The Renewable Fuels Module (RFM) includes submodules representing natural resource supply and technology input information for central-station, grid-connected electricity generation technologies, including biomass (wood, energy crops, and biomass co-firing), geothermal, landfill gas, solar thermal, solar photovoltaics, and wind energy. The RFM contains natural resource supply estimates representing the regional opportunities for renewable energy development. Conventional hydroelectricity is represented in the Electricity Market Module (EMM).

Oil and Gas Supply Module

The Oil and Gas Supply Module represents domestic crude oil and natural gas supply within an integrated framework that captures the interrelationships between the various sources of supply: onshore, offshore, and Alaska by both conventional and nonconventional techniques, including gas recovery from coalbeds and low-permeability formations of sandstone and shale. This framework analyzes cash flow and profitability to compute investment and drilling for each of the supply sources, subject to the prices for crude oil and natural gas, the domestic recoverable resource base, and technology. Oil and gas production functions are computed at a level of 12 supply regions, including 3 offshore and 3 Alaskan regions. This module also represents foreign sources of natural gas, including pipeline imports, exports to Canada and Mexico, and liquefied natural gas imports and exports. Crude oil production quantities are input to the Petroleum Market Module in NEMS for conversion and blending into refined petroleum products. Supply curves for natural gas are input to the Natural Gas Transmission and Distribution Module for use in determining natural gas prices and quantities.

Natural Gas Transmission and Distribution Module

The Natural Gas Transmission and Distribution Module represents the transmission, distribution, and pricing of natural gas, subject to end-use demand for natural gas and the availability of domestic natural gas and natural gas traded on the international market. The module tracks the flows of natural gas in an aggregate, domestic pipeline network, connecting the domestic and foreign supply regions with 12 demand regions. This capability allows the analysis of impacts of regional capacity constraints in the interstate natural gas pipeline network and the identification of pipeline and storage capacity expansion requirements. Peak and off-peak periods are represented for natural gas transmission, and core and non-core markets are represented at the burner tip. Key components of pipeline and distributor tariffs are included in the pricing algorithms.

Petroleum Market Module

The Petroleum Market Module (PMM) forecasts prices of petroleum products, crude oil and product import activity, and domestic refinery operations, including fuel consumption, subject to the demand for petroleum products, availability and price of imported petroleum, and domestic production of crude oil, natural gas liquids, and alcohol fuels. The module represents refining activities for three regions—Petroleum Administration for Defense District (PADD) 1, PADD 5, and an aggregate of PADDs 2, 3, and 4. The module uses the same crude oil types as the International Module. It explicitly models the requirements of CAAA90 and the costs of automotive fuels, such as oxygenated and reformulated gasoline, and includes oxygenate production and blending for reformulated gasoline. *AEO2003* reflects legislation that bans or limits the use of the gasoline blending component methyl tertiary butyl ether (MTBE) in the next several years in Arizona, California, Colorado, Connecticut, Illinois, Indiana, Iowa, Kansas, Kentucky, Maine, Michigan, Minnesota, Missouri, Nebraska, New York, Ohio, South Dakota, and Washington.

Because the *AEO2003* reference case assumes current laws and regulations, it assumes that the Federal oxygen requirement for reformulated gasoline in Federal nonattainment areas will remain intact. The “Tier 2” regulation that requires the nationwide phase-in of gasoline with a greatly reduced annual average sulfur content, 30 parts per million (ppm), between 2004 and 2007 is explicitly modeled. The new “ultra-low-sulfur diesel” regulation finalized in December 2000 is also explicitly modeled. The diesel regulation requires that 80 percent of the highway diesel produced between June 1, 2006, and May 31, 2010, have a maximum sulfur content of 15 ppm, and that all highway diesel fuel meet the same limit after June 1, 2010. Costs of the regulation include capacity expansion for refinery processing units based on a 10-percent hurdle rate and a 10-percent after-tax return on investment. End-use prices are based on the marginal costs of production, plus markups representing product and distribution costs, State and Federal taxes, and environmental site costs. *AEO2003* assumes that refining capacity expansion may occur on the East Coast, West Coast, and Gulf Coast.

Coal Market Module

The Coal Market Module simulates mining, transportation, and pricing of coal, subject to the end-use demand for coal differentiated by physical characteristics, such as the heat and sulfur content. The coal supply curves include a response to capacity utilization of mines, mining capacity, fuel costs, labor

productivity, and factor input costs. Twelve coal types are represented, differentiated by coal rank, sulfur content, and mining process. Production and distribution are computed for 11 supply and 13 demand regions, using imputed coal transportation costs and trends in factor input costs. The Coal Market Module also forecasts the requirements for U.S. coal exports and imports. The international coal market component of the module computes trade in 3 types of coal for 16 export and 20 import regions. Both the domestic and international coal markets are simulated in a linear program.

Cases for the *Annual Energy Outlook 2003*

The *AEO2003* presents five cases which differ from each other due to fundamental assumptions concerning the domestic economy and world oil market conditions. Three alternative assumptions are specified for each of these two factors, with the reference case using the midlevel assumption for each.

- **Economic Growth** - In the reference case, productivity grows at an average annual rate of 2.1 percent from 2001 through 2025 and the labor force at 0.9 percent per year, yielding a growth in real GDP of 3.0 percent per year. In the high economic growth case, productivity and the labor force grow at 2.3 and 1.2 percent per year, respectively, resulting in GDP growth of 3.5 percent annually. The average annual growth in productivity, the labor force, and GDP is 1.8, 0.7 and 2.5 percent, respectively, in the low economic growth case.
- **World Oil Markets** - In the reference case, the average world oil price increases to \$26.57 per barrel (in real 2001 dollars) in 2025. Reflecting uncertainty in world markets, the price in 2025 reaches \$19.04 per barrel in the low oil price case and \$33.05 per barrel in the high oil price case.

In addition to these five cases, additional cases presented in Table 1 explore the impacts of changing key assumptions in individual sectors.

Many of the side cases were designed to examine the impacts of varying key assumptions for individual modules or a subset of the NEMS modules, and thus the full market consequences, such as the consumption or price impacts, are not captured. In a fully integrated run, the impacts would tend to narrow the range of the differences from the reference case. For example, the best available technology side case in the residential demand assumed that all future equipment purchases are made from a selection of the most efficient technologies available in a particular year. In a fully integrated NEMS run, the lower resulting fuel consumption would have the effect of lowering slightly the market prices of those fuels with the concomitant impact of increasing economic growth, thus stimulating some additional consumption. As another example, the higher electricity demand side case results in higher electricity prices. If the end-use demand modules were executed in a full run, the demand for electricity would be reduced slightly as a result of the higher prices and resulting lower economic growth, thus moderating somewhat the input assumptions. The results of these cases should be considered the maximum range of the impacts that could occur with the assumptions defined for the case.

All projections are based on Federal, State, and local laws and regulations in effect on September 1, 2001, including the additional fuels taxes in the Omnibus Budget Reconciliation Act of 1993, the CAAA90, the Energy Policy Act of 1992, the Outer Continental Shelf Deep Water Royalty Relief Act of 1995, the Tax Payer Relief Act of 1997, the Federal Highway Bill of 1998, new standards for gasoline and diesel fuel and heavy-duty vehicle emissions, and the new equipment standards announced in 2001. Pending legislation and sections of existing legislation for which funds have not been appropriated are not reflected in these forecasts.

Table 1. Summary of AEO2003 Cases

Case name	Description	Integration mode
Reference	Baseline economic growth, world oil price, and technology assumptions	Fully integrated
Low Economic Growth	Gross domestic product grows at an average annual rate of 2.5 percent, compared to the reference case growth of 3.0 percent.	Fully integrated
High Economic Growth	Gross domestic product grows at an average annual rate of 3.5 percent, compared to the reference case growth of 3.0 percent	Fully integrated
Low World Oil Price	World oil prices are \$19.04 per barrel in 2025, compared to \$26.57 per barrel in the reference case	Fully integrated
High World Oil Price	World oil prices are \$33.05 per barrel in 2025, compared to \$26.57 per barrel in the reference case	Fully integrated
Residential: 2003 Technology	Future equipment purchases based on equipment available in 2003. Existing building shell efficiencies fixed at 2003 levels	With commercial
Residential: High Technology	Earlier availability, lower costs, and higher efficiencies assumed for more advanced equipment. Heating shell efficiency increases by 12 percent from 1997 values by 2025.	With commercial
Residential: Best Available Technology	Future equipment purchases and new building shells based on most efficient technologies available. Heating shell efficiency increases by 16 percent from 1997 values by 2025.	With commercial
Commercial: 2003 Technology	Future equipment purchases based on equipment available in 2003. Building shell efficiencies fixed at 2003 levels.	With residential
Commercial: High Technology	Earlier availability, lower costs, and higher efficiencies assumed for more advanced equipment. Building shell efficiencies increase 50 percent faster than in the reference case.	With residential
Commercial: Best Available Technology	Future equipment purchases based on most efficient technologies available. Building shell efficiencies increase 50 percent faster than in the reference case.	With residential
Industrial: 2003 Technology	Efficiency of plant and equipment fixed at 2003 levels.	Standalone
Industrial: High Technology	Earlier availability, lower costs, and higher efficiencies assumed for more advanced equipment.	Standalone
Transportation: 2003 Technology	Efficiencies for new equipment in all modes of travel are fixed at 2003 levels	Standalone
Transportation: High Technology	Reduced costs and improved efficiencies are assumed for advanced technologies.	Standalone
Integrated 2003 Technology	Combination of the residential, commercial, industrial, and transportation 2003 technology cases, electricity low fossil technology case, and assumption of renewable technologies fixed at 2002 levels.	Fully Integrated
Integrated High Technology	Combination of the residential, commercial, industrial, and transportation high technology cases, electricity high fossil technology case, high renewables case, and advanced nuclear cost case.	Fully Integrated
Electricity: Advanced Nuclear Cost	New nuclear capacity is assumed to have both lower capital costs than in the reference case	Partially integrated
Electricity: High Demand	Electricity demand increases at an annual rate of 2.5 percent, compared to 1.8 percent in the reference case.	Partially Integrated
Electricity: High Fossil Technology	New advanced fossil generating technologies are assumed not to improve over time from 2003.	Partially Integrated

Table 1. Summary of AEO2003 Cases (Continued)

Cases	Description	Integration Mode
Renewables: High Renewables	Lower costs and higher efficiencies for central-station renewable generating technologies and for distributed photovoltaics, approximating U.S. Department of Energy goals for 2025. Includes greater improvements in residential and commercial photovoltaic systems, more rapid improvement in recovery of industrial biomass byproducts, and more rapid improvement in cellulosic ethanol production technology.	Fully integrated
Oil and Gas: Slow Technology	Cost, finding rate, and success rate parameters adjusted for 15-percent slower improvement than in the reference case.	Fully integrated
Oil and Gas: Rapid Technology	Cost, finding rate, and success rate parameters adjusted for 15-percent more rapid improvement than in the reference case.	Fully integrated
Coal: Low Mining Cost	Productivity increases at an annual rate of 3.1 percent, compared to the reference case growth of 1.6 percent. Real wages and real mine equipment costs decrease by 0.5 percent annually, compared to constant real wages and equipment costs in the reference case.	Fully integrated
Coal: High Mining Cost	Productivity increases at an annual rate of 0.1 percent, compared to the reference case growth of 1.6 percent. Real wages and real mine equipment costs increase by 0.5 percent annually, compared to constant real wages and equipment costs in the reference case.	Fully integrated

Emissions

Carbon dioxide emissions from energy use are dependent on the carbon dioxide content of the fuel and the fraction of the fuel consumed in combustion. The product of the carbon dioxide content at full combustion and the combustion fraction yields an adjusted carbon dioxide emission factor for each fuel. The emissions factors are expressed in millions of metric tons carbon equivalent of carbon dioxide emitted per quadrillion Btu of energy use, or equivalently, in kilograms carbon equivalent of carbon dioxide per million Btu. The adjusted emissions factors are multiplied by energy consumption to arrive at the carbon dioxide emissions projections.

For fuel uses of energy, the combustion fractions are assumed to be 0.99 for liquid fuels and 0.995 for gaseous fuels. The carbon dioxide in nonfuel use of energy, such as for asphalt and petrochemical feedstocks, is assumed to be sequestered in the product and not released to the atmosphere. For energy categories that are mixes of fuel and nonfuel uses, the combustion fractions are based on the proportion of fuel use. Any carbon dioxide emitted by renewable sources is considered balanced by the carbon dioxide sequestration that occurred in its creation. Therefore, following convention, net emissions of carbon dioxide from renewable sources are taken as zero, and no emission coefficient is reported. Renewable fuels include hydroelectric power, biomass, photovoltaic, geothermal, ethanol, and wind energy.

Table 2 presents the carbon dioxide coefficients at full combustion, the combustion fractions, and the adjusted carbon dioxide emission factors used for *AEO2003*.

Table 2. Carbon Dioxide Emission Factors
(Kilograms-carbon equivalent per million Btu)

Fuel Type	Carbon Dioxide Coefficient at Full Combustion	Combustion Fraction	Adjusted Emissions Factor
Petroleum			
Motor Gasoline	19.34	0.990	19.15
Liquefied Petroleum Gas			
Used as Fuel	17.18	0.995	17.09
Used as Feedstock	16.87	0.200	3.37
Jet Fuel	19.33	0.990	19.14
Distillate Fuel	19.95	0.990	19.75
Residual Fuel	21.49	0.990	21.28
Asphalt and Road Oil	20.62	0.000	0.00
Lubricants	20.24	0.600	12.14
Petrochemical Feedstocks	19.37	0.200	3.87
Kerosene	19.72	0.990	19.52
Petroleum Coke	27.85	0.500	13.93
Petroleum Still Gas	17.51	0.995	17.42
Other Industrial	20.31	0.990	20.11
Coal			
Residential and Commercial	26.00	0.990	25.74
Metallurgical	25.56	0.990	25.30
Industrial Other	25.63	0.990	25.38
Electric Utility ¹	25.76	0.990	25.50
Natural Gas			
Used as Fuel	14.47	0.995	14.40
Used as Feedstocks	14.47	0.774	11.20

¹Emission factors for coal used for electricity generation are specified by coal supply region and types of coal, so the average carbon dioxide contents for coal varies throughout the forecast. The 2000 average is 25.50.

Source: Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2000*, DOE/EIA-0573(2000), (Washington, DC, November 2001).

Methane emissions from energy-related activities are now estimated in NEMS. Methane emissions occur in various phases of the production and transportation of coal, oil, and natural gas. Additional emissions occur as a result of incomplete combustion of fossil fuels and wood. The methane emissions from each category are calculated as a function of energy production or consumption variables projected in NEMS. The emission factors and coefficients for these calculations are displayed in Tables 3, 4, and 5.

Table 3. Coal-Related Methane Assumptions

	Northern Appalachia	Central Appalachia	Southern Appalachia	Eastern Interior	Western
Fraction of underground coal production at:					
Gassy mines	0.885	0.368	0.971	0.876	0.681
Nongassy mines	0.115	0.632	0.029	0.124	0.319
Production from mines with degasification systems (fraction of underground production)					
	0.541	0.074	0.810	0.067	0.056
Emission factors (kilograms methane per short ton of coal produced)					
Underground Mining					
Gassy mines	6.047	5.641	27.346	2.988	6.027
Nongassy mines	0.362	0.076	15.959	0.285	0.245
Degassified mines	4.085	37.724	22.025	0.310	0.000
Surface Mining	0.706	0.706	0.706	0.706	0.706
Post-Mining, underground-mined					
	1.505	1.505	1.505	1.505	1.505
Post-Mining, surface-mined					
	0.061	0.061	0.061	0.061	0.061
Methane recovery at active coal mines (million metric tons carbon equivalent)					
	United States				
	2001	4.400			
	2005	4.645			
	2010	4.970			
	2015	5.317			
	2020	5.689			
	2025	6.087			

Source: Emissions factors and data sources from Energy Information Administration, *Emissions of Greenhouse Gases in the United States 20001*, DOE/EIA-0573(2001), (Washington, DC, December 2002).

Table 4. Coefficients of Linear Equations for Natural Gas- and Oil-Related Methane Emissions

Emissions Sources	Intercept	Variable Name and Units	Coefficient	Variable Name and Units	Coefficient
Natural Gas	-38.77	Time trend (calendar year)	.02003	Dry gas production (thousand cubic feet)	.02186
Natural Gas Processing	-0.9454	Natural gas liquids production (million barrels per day)	.9350	Not applicable	
Natural Gas Transmission and Storage	2.503	Pipeline fuel use (thousand cubic feet)	1.249	Dry gas production (thousand cubic feet)	-0.06614
Natural Gas Distribution	-58.16	Time trend (calendar year)	.0297	Natural gas consumption (quadrillion Btu)	.0196
Oil production, Refining, and Transport	0.03190	Oil consumption (quadrillion Btu)	.002764	Not applicable	

Source: Derived from data used in Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2001*, DOE/EIA-0573(2001), (Washington, DC, December 2002).

Table 5. Methane Emissions Factors for Energy Combustion
(Metric tons carbon equivalent per trillion Btu)

	Residential	Commercial	Industrial	Electricity
Stationary Combustion				
Coal	3.61	63.08	15.14	3.78
Residual Fuel	0.00	10.09	18.29	4.42
Distillate Fuel	31.54	3.78	1.01	0.00
Natural Gas	6.02	7.23	8.43	0.60
Liquid Gases	7.27	7.27	8.63	0.00
Wood	5531.11	18.44	16.78	0.00
Mobile Combustion				
Passenger Cars	70.54			
Buses	40.78			
Motorcycles	1115.63			
Light-Duty Trucks	90.46			
Other Trucks	23.98			
Other Transport	46.92			

Source: Emissions factors and data sources from Energy Information Administration, *Emissions of Greenhouse Gases in the United States 2000*, DOE/EIA-0573(2000), (Washington, DC, November 2001).

Notes and Sources

- [1] Energy Information Administration, Annual Energy Outlook 2003 (AEO2003), DOE/EIA-0383(2003), (Washington, DC, January 2003).
- [2] NEMS documentation reports are available on the EIA Homepage (<http://www.eia.doe.gov/bookshelf.html>).
- [3] Energy Information Administration, The National Energy Modeling System: An Overview 2000, DOE/EIA-0581(2000), (Washington, DC, March 2000).

